

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE**

Department of physiology, biochemistry of plants and bioenergetics

CONFIRMED

Faculty of Plant Protection, Biotechnology and Ecology

“20” May 2026

PROGRAM OF THE COURSE

PLANT PHYSIOLOGY WITH BASICS OF BIOCHEMISTRY

Field of knowledge 20 “Agricultural sciences and food”

Specialization 202 Plant protection and quarantine

Educational program Plant protection and quarantine

Faculty of Plant Protection, Biotechnology and Ecology

Developers: docent, Ph.D. Babytskiy A.I., docent PhD Boiko O.A.

Description of the course «Objects of biotechnological production»

The mechanisms of the main life processes in plants are described, the structural and functional organization of plant systems of different levels of organization is revealed, and the ways of plant organism management for optimization of crop cultivation, plant protection and protection of natural phytocenoses are substantiated.

The main tasks of the discipline "Plant Physiology with basics of biochemistry " are the study by students of the laws of vital functions, the disclosure of their mechanisms, the formation of ideas about the structural and functional organization of plant systems at different levels; obtaining and generalizing new knowledge about the physiological functions of the plant organism and the ability to control the production process of phytocenoses to create a theoretical basis for the rational use and protection of flora, the acquisition of practical skills in the laboratory of plant physiology.

Branch of knowledge, training direction, specialty, education level		
Educational degree	Bachelor	
Specialization	202 «Plant protection and quarantine»	
Educational program	«Plant protection and quarantine»	
Characteristics of the course		
Type	Compulsory	
Total number of hours	120	
Number of credits ECTS	4	
Number of content modules	2	
Course project (work)	-	
Form of control	Exam	
Indicators of the discipline for full-time higher education		
	Form of higher education	
	full-time	full-time
Course (year of study)	2	
Semester	4	
Lecture classes	15 hours	
Practical, seminar classes	-	
Laboratory classes	30 hours	
Self-study	75 hours	
Individual tasks	-	
Number of weekly classroom hours for full-time higher education	3 hours	

Purpose, tasks, competencies and program outcomes of the discipline

The **purpose** of studying the discipline "Plant Physiology with the basics of biochemistry" is to learn the laws of vital functions of plants, the disclosure of their mechanisms, forming an idea of structural and functional organization of plant systems at different levels and developing ways to control the plant organism.

List of prerequisites for the course: RC13 "Botany", RC3 "Chemistry: Organic", RC3 "Chemistry: Inorganic and Analytical, Organic".

Acquisition of competencies:

General competencies (GC):

GC3. Знання і розуміння предметної області та розуміння професійної діяльності.

GC7. Здатність вчитися і оволодівати сучасними знаннями та пошуку.

Program learning outcomes (PLOs):

PLO3. Fluently communicate orally and in writing in Ukrainian and foreign languages on professional issues related to the specialty 'Plant Protection and Quarantine'.

PLO4. Know and understand mathematics and natural sciences to the extent necessary for professional activities in plant protection and quarantine.

PLO6. Correctly use appropriate methods of observation, description, identification, classification, cultivation of agrobiocenoses and maintenance of their stability to preserve natural diversity.

PLO16. Know the main historical stages of development of the subject area.

2. Program and structure of the discipline

Names of content modules and topics	Number of hours													
	full-time education							correspondence form of training						
	weeks	total	included					total	included					
			lec	prac	lab.	ind.	in.w.		lec	prac	lab.	ind.	in.w.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Content module 1. Plant cell physiology and patterns of water exchange														
Topic 1 Introduction. Subject, purpose and tasks, directions and methods of modern plant physiology. History of the formation of plant physiology as a science	1	14	2		2		10	2	2		1			4
Topic 2. Plant cell physiology	3	17	3		4		10							10
Topic 3. Water exchange of plants	5	23	2		6		15	4			2			10
Total hours:		54	7		12		35		2		3			24
Content module 2. Energy processes of the plant organism and physiology of nutrition, growth and development of plants														
Topic 1.	7	20	2		8		10	4			1			10

Photosynthesis												
Topic 2. Plant respiration	9	16	2		4		10	2				10
Topic 3. Mineral nutrition of plants	11	14	2		2		10				2	10
Topic 4. Plant growth and development, adaptation of plants to environmental conditions	13	16	2		4		10					10
Total hours:		66	8		18		40				3	40
The total number of hours:	15	120	15		30		75	72	2		6	64

3. Lecture topics

№ з/п	Назва теми	Кількість годин
1	Introduction. Subject, purpose and tasks, directions and methods of modern plant physiology. History of the formation of plant physiology as a science	2
2	Plant cell physiology	3
3	Water exchange of plants	2
4	Photosynthesis	2
5	Plant respiration	2
6	Mineral nutrition of plants	2
7	Plant growth and development, adaptation of plants to environmental conditions	2
	Total:	15

4. Topics of laboratory (practical, seminar) classes

4.1. Topics of the laboratory classes

№	Topic title	Number of hours
1.	Structure of a plant cell	2
2.	Determination of membrane permeability	2
3.	The phenomenon of plasmolysis and deplasmolysis in plant cells	2
4.	Determination of sucrose activity	2
5.	Determination of the rate of water absorption by a plant	2
6.	Determination of stomata condition by infiltration method	2
7.	Determination of plant tissue tension by the method of strips	2
8.	Dependence of transpiration intensity on environmental conditions	2

9.	Physical and chemical properties of pigments	2
10.	Distribution of pigments by paper chromatography	2
11.	Determination of chlorophyll concentration by photolorimetric method	2
12.	Determination of photosynthesis intensity by gasometric method	2
13.	Detection of enzymes of oxidative electron transport chains	2
14.	Determination of the intensity of plant respiration	2
15.	Microchemical analysis of ash	2
	Total:	30

5. Topics for individual work

№	Topic title	Number of hours
1.	History of phytophysiology development in Ukraine	5
2.	Plant cell membrane as a factor of compartmentalization	5
3.	Features of physiological processes in a plant cell	5
4.	Biochemical composition of a plant cell	5
5.	Determination of indicators of water metabolism of plants	5
6.	Biological and ecological features of plants with different pathways of photosynthesis	5
7.	Physiological features of photosynthesis	5
8.	Calculation of photosynthetic parameters	5
9.	Determination of the intensity of plant respiration	5
10.	Determination of the respiratory coefficient of plants	5
11.	Physiological features of plant mineral nutrition	5
12.	Calculation of nutrients	5
13.	Physiological features of plant growth and development	5
14.	Physiological features of plant morphogenesis regulation	5
15.	Physiological patterns of plant resistance development	5
	Total:	75

6. Methods and Criteria for Assessment of Learning Outcomes

- - exam;
- - module tests;
- - oral and written questioning;
- - defence of laboratory work;
- - abstracts;
- - peer assessment, self-assessment.

7. Teaching methods:

- Problem-based learning method;
- Practice-based learning method;
- Research-based learning method;
- Discussion and debate method;

- Teamwork method;

8. Assessment of learning outcomes.

The assessment of the knowledge of the applicant for higher education is carried out on a 100-point scale and is converted into a national grade in accordance with the current 'Regulations on exams and tests in NUBiP of Ukraine'

8.1. Distribution of Points by Types of Learning Activities

Type of learning activity	Learning outcomes	Evaluation
Module 1. Plant cell physiology and patterns of water exchange		
L. c. 1. Structure of a plant cell	PLO3, PLO4	10
L. c. 2. Determination of membrane permeability		10
L. c. 3. The phenomenon of plasmolysis and deplasmolysis in plant cells		10
L. c. 4. Determination of sucrose activity		10
L. c. 5. Determination of the rate of water absorption by a plant		10
L. c. 6. Determination of stomata condition by infiltration method		10
Individual work 1. Physiology of plant cell and patterns of water exchange.		10
Modular test work 1.		30
Total by module 1		100
Module 2. Energy processes of the plant organism and physiology of nutrition, growth and development of plants		
L. c. 7. Determination of plant tissue tension by the method of strips	PLO6, PLO16	7
L. c. 8. Dependence of transpiration intensity on environmental conditions		7
L. c. 9. Physical and chemical properties of pigments		7
L. c. 10. Distribution of pigments by paper chromatography		7
L. c. 11. Determination of chlorophyll concentration by photolorimetric method		7
L. c. 12. Determination of photosynthesis intensity by gasometric method		7
L. c. 13. Detection of enzymes of oxidative electron transport chains		7
L. c. 14. Determination of the intensity of plant respiration		7
L. c. 15. Microchemical analysis of ash		7
Individual work 2. Energy processes of the plant organism and physiology of nutrition, growth and development of plants		7
Modular test work 2.		30
Total by module 2		
Educational work		(M1 + M2)/3*0,7 ≤ 70
Exam / test		30

Total for the course	(Academic work + exam) ≤ 100
----------------------	------------------------------

8.2. Scale for assessing the knowledge of a higher education student

Rating of higher education applicants, points	Grading according to the national system (exams/tests)
90-100	Exams
74-89	Excellent
60-73	Good
0-59	Satisfactory

8.3. Assessment policy

Policy on deadlines and retakes	Works that are submitted late without valid reasons will be assessed with a lower grade. Modules may be retaken with the permission of the lecturer if there are valid reasons (e.g. sick leave).
Policy on academic integrity	Cheating during tests and examinations is prohibited (including using mobile devices). Essays must have correct textual references to the literature used
Attendance policy	Attendance is compulsory. For objective reasons (e.g. illness, international internship), training can take place individually (online in agreement with the dean of the faculty)

9. Educational and methodological support:

- - electronic training course of the discipline (on the educational portal of NULES of Ukraine eLearn - <https://elearn.nubip.edu.ua/course/view.php?id=1118>);
- - lecture notes and presentations (in electronic form);
- - textbooks, manuals, workshops;
- - methodological materials for studying the discipline for full-time and part-time students.

10. Recommended sources of information

Main literature

1. Plant physiology: a textbook / S.V. Prylutska, A.I. Babytskyi, N.H. Nesterova, T.A. Tkachenko, P.Y. Drozd - Kyiv: NUBiP of Ukraine, 2023. 224 p.
2. Plant physiology: a textbook / S.V. Prylutska, A.I. Babytskyi, N.H. Nesterova, T.A. Tkachenko, O.A. Boiko, A.V. Dashchenko - Kyiv: NUBiP of Ukraine, 2024. 215 p.
3. Musienko M.M. Plant Physiology: Textbook (for students of higher educational institutions) - K.: Lybid, 2005. - 808 p.
4. Musienko M.M. Plant Physiology: Textbook - K.: Phytosociocenter, 2001. - 392 p.
5. Makrushyn M.M., Makrushyna E.M., Peterson N.V. et al. Physiology of agricultural plants with the basics of biochemistry - K.: Urozhay, 1995. - 352 p.
6. Makrushyn M.M., Makrushyna E.M., Petersen N.V., Menshikov M.M. Plant Physiology - Vinnytsia: "New Book", 2006. - 416 p.

7. Samoilenko T.G., Samoilenko M.O., Rozhok O.F. Workshop on plant physiology: Study guide. - Mykolaiv: MNAU, 2013. - 431 p.
8. Romaniuk N.D., Tsvilynyuk O.M., Mykivych I.M., Terek O.I. Plant Physiology: A textbook for students of biological faculties of higher educational institutions: Pyramid, 2005. 160 p.
9. Nikolaychuk V.I., Belchhazi V.Y. Physiology and biochemistry of plants: Study guide for students of biological specialties of higher educational institutions - Uzhhorod: UzhNU, 2013. 192 p.
10. Bryon O.V., Chykalenko V.G., Slavnyi P.S., Merezhynskyi Y.Y., Bilanovskyi M.F. Plant Physiology: Workshop. - K.: Higher School, 1995. - 191 p.
11. Kozhukalo V.E., Marchenko O.M., Suray O.O. Methodical instructions for laboratory and practical classes for students of agrobiological faculties. - K.: NAU Publishing Center, 2006. - 46 p.
12. Methodical recommendations for laboratory classes in the discipline "Plant Physiology" for students of agrarian universities of agronomic specialties. - K.: Phytosociocenter, 2000. - 64 p.
13. Kazakov E.O. Methodological bases of setting up an experiment in plant physiology. - Kyiv: Phytosociocenter, 2000. - 272 p.
14. Musienko M.M. Photosynthesis. - K.: Higher School, 1995. - 247 p.

Supporting literature

1. Hrytsayenko Z.M., Hrytsayenko O.A., Karpenko V.P. Methods of biological and agrochemical research of plants and soils. - K.: CJSC "Nichlava", 2003. - 320 p.
2. Kostylov O.V., Romanenko O.V. Biology and ecology of autotrophic organisms. - K.: Phytosociocenter, 1999. - 192 p.
3. Musienko M.M., Parshikova T.V., Slavnyi P.S. Spectrophotometric methods in the practice of physiology, biochemistry and plant ecology. - Kyiv: Phytosociocenter, 2001. - 200 p.
4. Grodzinsky D.M. Fundamentals of chemical interaction of plants. - K.: Nauk. dumka, 1973. - 206 p.
5. Rudyshyn S.D. Fundamentals of plant biotechnology. Textbook for higher agricultural institutions. - Vinnytsia, 1998. - 234 p.

Information resources

1. Plant Physiology <https://goo-gl.su/W4tYoy>
2. Photosynthesis <https://goo-gl.su/ozqA4t8>
3. Plant Physiology <http://www.plantphysiol.org/>
4. Photosynthesis https://www.youtube.com/watch?v=sQK3Yr4Sc_k
5. Mineral nutrition of plants https://www.youtube.com/playlist?list=PLKIDmF-iIyAljqtM4XB1ojpOC_iw1s3fN